International Journal of Civil Engineering and Technology (IJCIET)
Volume 7, Issue 1, Jan-Feb 2016, pp. 172-179, Article ID: IJCIET_07_01_014
Available online at
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=7&IType=1
Journal Impact Factor (2016): 9.7820 (Calculated by GISI) www.jifactor.com
ISSN Print: 0976-6308 and ISSN Online: 0976-6316

EXPERIMENTAL INVESTIGATION OF FLOODING PROBLEM- A CASE STUDY ON ARUNAVATI RIVER IN SHIRPUR CITY BY TOTAL STATION SURVEY

Prof. Hemraj R Kumavat
Assistant Professor, Department of Civil Engineering,
R. C. Patel Institute of Technology, Shirpur, Maharashtra, India

Prof. Ganesh V Tapkire
Assistant Professor, Department of Civil Engineering,
R. C. Patel Institute of Technology, Shirpur, Maharashtra, India

ABSTRACT

Nowadays Total station has become an effective tool for analyzing the land cover change from the view point of economy. The main objective of present research is to cover the defects occurring due to flooding pattern of river & its problem of unnecessary widening observing all the factors of safety related to it. This study was conducted along the river of the Arunavati, which are frequently affected by the floods and due to that erosion is happening. Total station survey was useful for detecting the land cover change & suggesting the necessary steps for precautions needed for future flooding pattern. The problem is serious and should be inspected regularly. Otherwise, there is chance of river widening which can lead greater damage to surrounding features which is located near site of river line.

Key words: Flood Problem, River Line Survey, Total Station

Cite this Article: Prof. Hemraj R Kumavat and Prof. Ganesh V Tapkire, Experimental Investigation of Flooding Problem- A Case Study on Arunavati River in Shirpur City by Total Station Survey, *International Journal of Civil Engineering and Technology*, **7**(1), 2016, pp. 172-179.
http://www.iaeme.com/IJCIET/issues.asp?JType=IJCIET&VType=7&IType=1

1. INTRODUCTION

Total station survey is playing important role in detection of river line change periodically. Many total station surveys are now undertaken in remote and undeveloped localities. A total station survey is key issue in channel monitoring. If

medium scale survey is not economical by using periodical observation through GPS technique, so that total station survey is preferable for periodical observation.

The assumed coordinate system data can be used to quantify longitudinal and cross-sectional characteristics of the river. These data can also be used to generate topographic maps of the river basin, streambed, gravel bars, river line, and difference in flood line. On the other hand, the features such as bridge structure, diversion structures, bank-protection structures and reservoir line also can be surveyed.

The measurements will be periodically in subsequent years to evaluate river line change. The interval between periodical measurements will be determined partly by the hydrologic history and geomorphic response of the river.

A survey of the stream channel is a critical component of the monitoring activities and provides a reference for other measurements and photographs.[1] Replicate channel surveys with a common datum and coordinate system will enable detection of geomorphic change that might occur as a result of flood scour, bed-material aggradations, or lateral channel migration (Emmett and Hadley, 1968).

2. STUDY AREA

Table 1 Geographic location of the area

Location	**Arunavati River, Shirpur Taluka, Dhule district of Maharashtra State**
At Dam site	
Left bank of river	21^0 20’ 29.58” north & 74^0 53’ 23.83”east
Right bank of river	21^0 20’ 27.19” north & 74^0 53’ 30.14”east
At widening	
Left bank of river	21^0 20’ 5.51” north & 74^0 53’ 13.04”east
Right bank of river	21^0 20’ 3.92” north & 74^0 53’ 13.91”east
Dam length	200.0m
River existing span at dam site	188.0m
Old bridge span	140.48m
New bridge span	222.47m
Old river span	82.5m
Existing river span	118.5m
Direction of river flow	North to south
Source height	450.0m
Total length	53 km
Total catchment area	935 km^2

3. METHODOLOGY

Using local assumed coordinate system is a common practice in total station surveys, where a pre-existing horizontal and vertical control network or GPS co- ordinates (longitude, latitude and gravity) is not available. At the time of progress of the survey assume easting’s, nothings and elevations (e.g., 5000, 5000, 100) positive values. Once the survey is begun on this assumed coordinate system, all additional station setups use a ‘back sight to known point. The assumed coordinate data collected from Arunavati river basin can be used to quantify longitudinal and cross-sectional characteristics of the river.

This work was divided in to three stages such as river cross section survey, river longitudinal survey and preparation of topographic map of particular locality.

3.1. River survey

The scope of river survey is to capture the topographic variability of the riverbed and nearby surfaces that the water may flow over. Vertically, the survey should include the deepest portion of the river to the top of the flood confining bank.

Figure 1 Arunavati River plan (Reference from Google Earth image)

3.2. Cross section survey

Generally cross section line marked to evaluate the deepest point position and profile of river along its transverse direction. Cross sections should be taken perpendicular to the river flow and extend along the river line at an average of about 3 to 6 times the mean river width. Cross section interval is determined by site condition and type of survey work. Cross sections can be spaced wider apart where the river span is uniform (has little curvature, similar cross-section shape, same grade etc) and should be spaced more closely where the river span is irregular (width or slope varies, bends are present, roughness varies), near bridge abutments and piers, and near flow-directing structures commonly used for detection of river line change.

Table 2 Coordinates and Reduced Level of point

Point No.	Northing	Easting	RL	Point Code	Point No.	Northing	Easting	RL	Point Code
1	5000	5000	100	TP1	47	4989.215	4884.88	102.598	N
2	4899.23	4945.25	100.08	TP2	48	4981.509	4827.982	102.632	N
3	4829.138	4946.937	101.836	O	49	4972.794	4811.844	101.234	D
4	4853.278	4945.897	101.052	O	50	4898.551	4863.129	99.166	C
5	4882.464	4959.88	100.487	O	51	4918.919	4890.409	100.193	C
6	4912.784	4980.677	100.819	O	52	4962.364	4925.192	99.673	C
7	4944.199	5008.793	100.872	O	53	4987.209	4964.628	99.664	C
8	4953.058	5019.435	100.283	O	54	4979.063	4992.72	99.602	C
9	4979.904	5037.067	100.288	O	55	5019.301	5027.803	99.632	C
10	5001.303	5057.42	101.027	O	56	5050.672	5049.595	99.3	C
11	5016.933	5072.705	101.333	O	57	5089.65	5070.09	99.175	C
12	5040.711	5094.149	101.63	O	58	5119.527	5094.577	99.376	C
13	5073.001	5124.353	101.984	O	59	5161.552	5141.014	100.06	C
14	5105.238	5179.832	102.379	O	60	5174.379	5161.567	100.04	C
15	5089.187	5193.505	103.993	N	61	5205.262	5172.482	99.912	TP3
16	5057.959	5176.443	103.356	N	62	5204.783	5165.007	99.56	TP4
17	5026.531	5131.199	103.101	N	63	5126.691	5200.654	101.245	O
18	5025.662	5105.659	102.37	N	64	5169.597	5229.878	100.816	O
19	4984.357	5073.218	102.178	N	65	5201.361	5261.856	99.217	O
20	4952.786	5043.475	102.277	N	66	5227.826	5302.461	99.733	O
21	4932.336	5018.909	101.696	W	67	5256.112	5333.996	98.568	O
22	4902.454	4985.06	100.845	N	68	5283.314	5375.611	100.191	C
23	4883.923	4967.803	100.688	N	69	5265.552	5415.725	102.471	N
24	4857.384	4954.642	100.975	N	70	5249.942	5363.017	102.946	N
25	4972.445	4827.68	101.411	N	71	5220.45	5325.246	103.537	N
26	4977.405	4859.478	102.257	O	72	5190.692	5286.023	103.43	N
27	4980.56	4887.526	101.75	O	73	5163.405	5247.254	103.33	N
28	5006.381	4936.099	101.764	O	74	5132.595	5219.118	103.242	N
29	5034.795	4970.437	101.472	O	75	5096.357	5207.135	104.094	N
30	5068.901	5008.03	100.915	O	76	5096.387	5207.159	104.105	N
31	5088.654	5026.156	100.841	O	77	5276.198	5161.447	100.361	O
32	5118.347	5052.625	100.404	O	78	5280.766	5198.188	99.17	O
33	5145.753	5071.586	100.155	O	79	5329.407	5288.756	99.113	O
34	5177.739	5092.525	99.974	O	80	5364.379	5372.423	99.365	O
35	5219.5	5117.939	99.96	O	81	5310.663	5395.068	99.807	C
36	5246	5130.891	99.862	O	82	5284.895	5331.823	98.056	C
37	5266.389	5138.43	100.017	B	83	5256.856	5270.461	100.38	C
38	5267.925	5130.306	103.041	N	84	5224.603	5217.924	100.217	C
39	5249.413	5123.955	100.597	N	85	5218.054	5201.827	100.258	C
40	5229.892	5110.765	99.835	N	86	5210.805	5187.301	100.152	C
41	5197.503	5084.198	100.117	N	87	5198.981	5176.789	99.951	B
42	5149.215	5055.656	100.03	N	88	5194.135	5166.448	99.994	B
43	5125.498	5029.242	101.016	N	89	5192.567	5165.764	99.948	B
44	5054.874	4969.522	102.56	N	90	5186.65	5158.497	99.65	B
45	5021.914	4942.714	102.682	N	91	5197.166	5155.984	99.63	B
46	4997.596	4910.026	102.958	N	92	5203.467	5163.269	99.661	B

TP = Traverse point location, O = Old river line, N = New river line, W = Well, B = Bridge structure C= Centre line of river, D= Dam site location

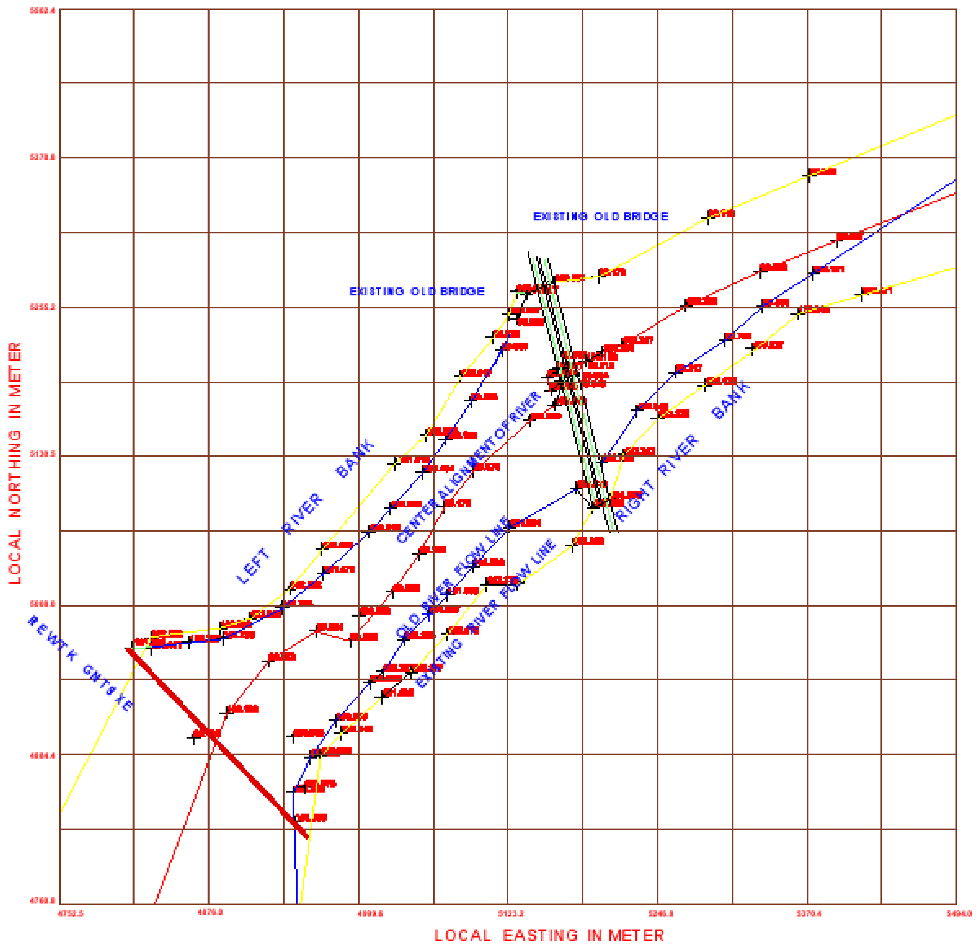

Figure 2 River Cross Section with Local Easting & Northing coordinates

3.3. Longitudinal survey

Longitudinal river survey is taken along the river line for determination of existing and old river edge line marks by flood plains. This indicates that river is widened along its cross section width. The surveyed points marked on that line gives the profile of river line with respect to its central alignment; it also shows the land coverage due to flooding. On the other hand, the features such as bridge structure, bank-protection structures and reservoir line also can be surveyed.

3.4 Survey point numbers and coding:-

Each surveyed point should have a unique number. Descriptive codes should be created for all bench marks, reference points, photo monuments, cross section end points, or other permanent monuments. Other descriptive codes might include: a cross-section identifier, the edge of water, high-water marks, top of bank, toe of bank or slope, change in vegetation and bridge abutments or piers, etc. Point numbers and descriptive codes help the subsequent investigators to reproduce and interpret the surveys.

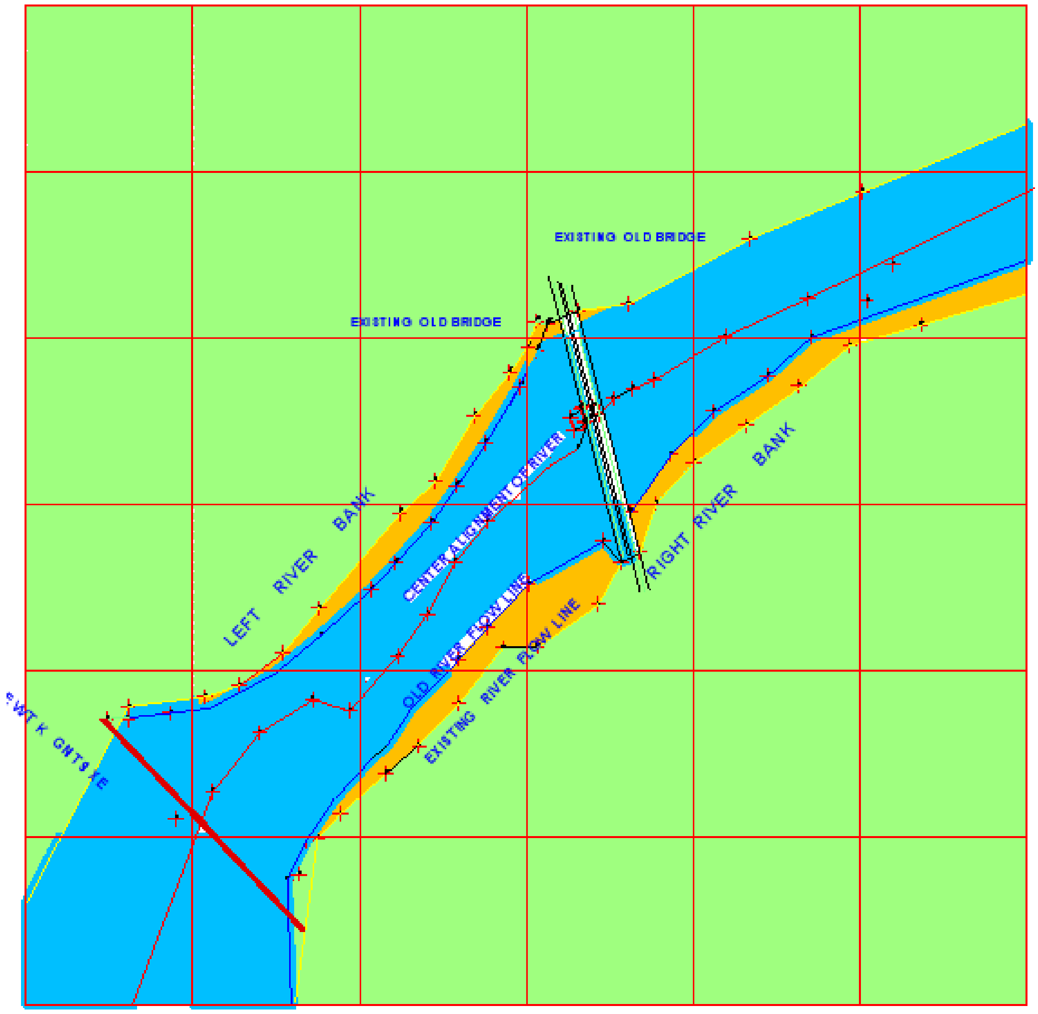

Figure 3 River Longitudinal plan with Surveyed point's location

4. RESULT AND DISCUSSION

After studied all visual and data observation, it is seen that the river is extremely widened at left and right edge of bank due to flooding occurs in past 10 years. This also indicates that the new bridge abutment position is displaced 20m from old bridge abutment position. If not paid due attention, due to continuous action of flooding, the river will be more widened and it is problem to surrounding features located near river line.

The table shows that local northing, easting coordinates and elevation of surveyed points with reference to known points (TBM). The fig. 3 shows that topographic details of stream bed such as old river line, existing new river line, center line of river which shows deepest point position of river, widened portion of river, catchment area of river as well as Bridge structure, dam structure and bank protection structure.

The fig.2 shows that data of surveyed points in Cartesian coordinate format so it can be used to quantify sediment deposit measurement, area of widening of river, storage volume of river and flood level difference.

5. CONCLUSION

The river survey by total station was more economical than GPS survey for periodical observation of same area. The research work demonstrate the ability of the challenges of flooding pattern is studied by total station, If not paid due attention, due to continues flooding river will be more widen and it is problem to surrounding features located near river line. So monitoring assessment of river is essential for preventing this type of problem. Coordinates data was very useful for locating position of structure such as bridge and dam because it was depend upon previous record taken by total station measurement.

FUTURE SCOPE OF WORK

Use of total station for measurement of per year flood marking level on abutment of bridge give the exact position of river widening line and flood level difference, this data can be used to predict the construction of new bridge structure and dam structure.

ACKNOWLDGEMENT

Prof. HEMRAJ R. KUMAVAT, **C**ompleted B.E. in Civil Engineering in 2003 and M.E. in Building Science and Technology in 2009 from North Maharashtra University, Jalgaon (MS). Published 10 research papers in international journal and presented 10 papers in international conference, 01 paper in national conference. Along with the publication author had attended 12 workshops sponsored by ISTE. Also he has associate member of IEI & LMISTE Have 2.5 year industrial experience of construction of various civil engineering projects like Building, Roads and Canals. From last 10 years he is working as Assistant Professor in Civil Engineering Department in R. C. Patel Institute of Technology, Shirpur, Dist. Dhule (MS)

Prof. GANESH V. TAPKIRE, Completed B.E. in civil Engineering 2008 and M-Tech appear in Building Construction &Technology in RGPV University Bhopal (MP).presented and Publish paper 04 Research paper in National conference and 01 International Journal along with publication author had attended 05 workshop sponsored by ISTE Also he has associate life member of ISTE. Have two years site experience in NH-3 Pimpalgaon-Dhule BOT Project. From last 3.6 year assistant professor in civil Engineering department in R.C.Patel.Instute of Techonology Shirpur

REFERENCE

[1] Kondolf, G.M., and Micheli, E.R., 1995, evaluating stream restoration projects: New York, Springer Verlag, Environmental Management, 19(1), p. 1-15.

[2] Kelman, I. and Spence, R. (2004), an overview of flood actions on buildings, Engineering Geology 73, 297–309.

[3] Somnath Maiti, Debrabata Ghorai, Rajat Satpathy, Jatisankar Bandyopadhyay. (2014)” Monitoring of Land Use Land Cover Change over the Years Due to River Course Shifting: A Case Study on Ganga River Basin near Malda District, West Bengal Using Geo-informatices Techniques, published in International Journal of Research in Advent Technology, 2(10), October 2014. E-ISSN: 2321-9637, pp- 83-90

[4] Elliott, J.G., and Hammack, L.A., 2000, Entrainment of riparian gravel and cobbles in an alluvial reach of a regulated canyon river, regulated rivers: Research & Management, 16, p. 37-50.

[5] Mosley, 1982, A procedure for characterizing river channels. Christchurch Water and Soil Science Centre, Ministry of Works and Development, Christchurch, New Zealand, Water and Soil Miscellaneous Publications no. 32, 67 p.

[6] Dr.Yerramsettyabbulu, Dr.P. Chandan Kumar and V.K.V.Bhadrudu, Approaches for Obtaining Design Flood Peak Discharges in Sarada River, Assam as Road Material, *International Journal of Civil Engineering and Technology*, **4**(4), 2013, pp. 113-118 .

[7] Wolman, M.G., 1954, A method of sampling coarse river-bed material: American Geophysical Union Transactions, v. 35, p. 951-956.

[8] Indira Baruah Gogoi Dr. Diganta Goswami and Dr. Girindra Deka, A Study of Geo-Engineering Properties of River-Borne Coarse Aggregates of River Pagladia, Baksa District, Assam as Road Material, *International Journal of Civil Engineering and Technology*, **6**(3), 2015, pp. 10-22 .